

and the ice ran out freely for a few hours, after which it stopped moving. During the 30th-31st the ice gorge continued at Fort Buford. On the 31st navigation opened at Sioux City, Iowa.

Lake Erie.—On the 4th the ice on the lake and in the river was broken up by a severe gale; 10th, ice considerably broken by a gale; 15th, ice badly broken by a gale and drifting down the river in large fields; 23d, ice drifting down the river in large fields. On the 5th the inner harbor at Cleveland, Ohio, was full of ice from 4 to 6 inches thick, and outside of the breakwater ice 6 to 10 inches thick extended as far as could be seen; this ice was driven in by a ne. wind. On the 10th nearly all the ice was driven out of the harbor by s. wind. On the 12th the first steamer of the season arrived from Detroit and returned on the 15th, being the first departure of the season. On the 24th the lake was covered with pack ice as far as could be seen. On the 29th no ice was visible.

Lake Huron.—On the 23d the south end of the lake was covered with floating ice and the Saint Clair River was full of floating ice. The night of the 24th communication by boat with points south of Marine City was closed, and on the 25th navigation was entirely closed on the Saint Clair River. On the 30th the ice jam in the Saint Clair River at Marine City gave way and navigation between local points resumed. On the 31st the lake was covered with floating ice at Port Huron and there was no marked indication of a resumption of navigation. At Alpena, Mich., the river and bay were clear of ice on the 28th. A schooner which left for Sand Beach on that date was obliged to return on account of ice in Thunder Bay.

Lake Michigan.—On the 3d 5 steamers were fast in the ice at Milwaukee, Wis.; 5th, ice drifted into harbor and the harbor was blocked by ice at night; 6th, the wind piled the ice on shore; 9th, harbor free of ice. On the 29th 2 boats, the first

of the season, arrived at Manistee, Mich., and the channel was free of ice at Green Bay, Wis.

Heights of rivers above low-water mark, March, 1891 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River.</i>						
Shreveport, La.	29.9	1	21.2	30	15.9	5.3
<i>Arkansas River.</i>						
Fort Smith, Ark.	22.0	31	12.9	23	3.8	9.1
Little Rock, Ark.	23.0	1, 10	12.7	28	8.5	4.2
<i>Missouri River.</i>						
Fort Buford, N. Dak.	21.0	27	12.2	2	4.0	8.2
<i>Kansas City, Mo.</i>						
<i>Mississippi River.</i>						
Saint Paul, Minn.	14.0					
La Crosse, Wis.	13.0					
Dubuque, Iowa *.	16.0					
Davenport, Iowa †.	15.0	25	7.1	12	2.3	4.8
Keokuk, Iowa.	14.0	28	11.0	16	1.8	9.2
Saint Louis, Mo.	30.0	30, 31	19.3	15, 16	6.8	12.5
Cairo, Ill.	40.0	4, 5, 6	46.2	30	41.9	4.3
Memphis, Tenn.	33.0	10	34.9	1	33.0	1.9
Vicksburg, Miss.	41.0	31	48.0	1	43.5	4.5
New Orleans, La.	13.0	17, 18	16.4	1	14.7	1.7
<i>Ohio River.</i>						
Pittsburgh, Pa.	22.0	14	13.8	7, 8	6.1	7.7
Parkersburg, W. Va.	38.0	16	21.9	7	10.4	11.5
Cincinnati, Ohio	45.0	1	50.3	24	32.2	18.1
Louisville, Ky.	24.0	1	30.4	25, 26	12.1	18.3
<i>Chamberland River.</i>						
Nashville, Tenn.	46.0	14	49.3	25	12.5	36.8
<i>Tennessee River.</i>						
Chattanooga, Tenn.	33.0	11	38.9	26	10.4	28.5
Knoxville, Tenn.	29.0	10	16.9	26	5.0	11.9
<i>Monongahela River.</i>						
Pittsburgh, Pa.	29.0	14	13.8	7, 8	6.1	7.7
<i>Savannah River.</i>						
Augusta, Ga.	32.0	10	35.5	4, 5	11.8	23.7
<i>Willamette River.</i>						
Portland, Oregon.	15.0	28	6.0	8	1.9	4.1

* Frozen.

† For 21 days.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were reported as follow: 3d, Clinton and Marshalltown, Iowa; Eastport, Me.; Fort Buford, N. Dak.; Kimball and Webster, S. Dak.; Medford, Wis. 4th, Clinton, Iowa. 5th, Ship Island, Miss. 6th, Clinton and Webster City, Iowa; Eastport, Me. 11th, Montevideo, Minn. 12th, Alta, Iowa; Caldwell, Mich.; Morris, Minn.; Webster, S. Dak. 13th, Saint Paul, Minn.; Ithaca, N. Y. 14th, Eastport, Me.; Cambridge and Fall River, Mass.; University, Miss. (first ever observed); Wedgewood, N. Y. 15th, Eastport, Me. 16th, Bar Harbor, Me.; Eagle's Mere, Pa. 17th, Alta, Iowa; Orono, Me. 18th, Webster City, Iowa. 26th, Coopersburgh, Pa. 28th, Amherst, Mass. 29th, New Hartford, Conn.; Moorestown, N. J. 30th, New Hartford, Southington, and Voluntown, Conn.; Sandwich, Ill.; Cornish and Orono, Me.; Amherst, Blue Hill Observatory, Cambridge, Concord, Fall River, Newburyport, North Billerica, and Royalston, Mass.; Berlin Mills, Groveton, Nashua, and Plymouth, N. H.; Moorestown, N. J.; Lowville and Wedgewood, N. Y.; Dyberry and Eagle's Mere, Pa.; East Berkshire and Northfield, Vt. 31st, Alta, Iowa; Eastport and Orono, Me.; Plymouth, N. H.; Kimball, S. Dak.; Northfield, Vt.

THUNDER-STORMS.

Thunder-storms were reported as follows: east of the Rocky Mountains thunder-storms were reported in the greatest number of states, 16, on the 7th; in 15 on the 30th; in 11 on the 21st and 29th; in 10 on the 8th; in 9 on the 9th; in 8 on the 6th, 20th, 22d, 25th, and 26th; in 7 on the 31st; in 6 on the 3d and 18th; in 4 on the 2d, 19th, 24th, 27th, and 28th; in 3 on the 5th, 10th, and 12th; in 2 on the 1st, 11th, 13th, 16th, 17th, and 23d, and in 1 on the 15th. The 4th and 14th were the only dates on which no thunder-storms were reported.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 13, in Ky. and Tex.; on 12 in N. C. and Tenn.; on 11 in Fla.; on 10 in Ill., Miss., and Mo.; on 9 in S. C.; on 8 in Ala., Ark., and La.; on 7 in Ga. and Kans.; on 4 in Ind.; on 3 in Iowa, Mass., N. J., and Okla. T.; on 2 in Conn., Md., Minn., Nebr., N. H., Ohio, Pa., Va., and Wis.; and on 1 in Mich., N. Y., and W. Va. West of the Rocky Mountains thunder-storms were reported as follows: Ariz., 6th, 11th, 18th, 21st to 24th, 30th, and 31st; Cal., 1st, 5th, 15th, 16th, 22d, 26th, and 27th; Colo., 17th and 28th; Idaho, 25th, 26th, and 27th; N. Mex., 11th, 21st, 22d, and 23d; Utah, 22d, 27th, and 31st. In Del., D. C., Ind. T., Me., Mont., Nev., N. Dak., Oregon, R. I., S. Dak., Vt., Wash., and Wyo., no thunder-storms were reported.

MISCELLANEOUS PHENOMENA.

SUN SPOTS.

Mr. D. E. Hadden, Alta, Iowa: 1st, 1 group, 2 spots; group in faculæ w. 3d, faculæ disappearing by rotation on w. limb. 5th, 1 group, 1 spot; group e. limb by rotation. 6th, 2 groups, 3 spots; groups e. and se.; faculæ e. and w. 8th, 1 group, 4 spots. 9th, 1 group, 6 spots; faculæ e. 10th, 1 group, 6 or

8 spots; group n. latitude on meridian. 11th, 1 group, 4 spots. 12th, 1 group, 2 spots; prominent faculæ by rotation on se. limb, followed by aurora in the evening; faculæ near e. and w. limbs. 13th, 1 group, 1 spot; large spot by rotation, just in on e. limb; group which was nw. on 12th had vanished. 14th, 1 group, 1 spot; faculæ by rotation se. limb. 15th, 1